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ELEPHONE ACCESSORIES YOU CAN BUILD

LES H. GILDER

Already one of the most common and useful of all home appliances, the telephone has the potential of being much more than simply a communicative device. It can remotely control other appliances, automatically dial any number (police, fire department) when triggered by an alarm, code phone conversations to insure privacy, even act as a burglar alarm when equipped with the proper accessories.

But up to now, these accessories have had to be purchased at prices ranging from $30 to $200 because, even though several books on telephone theory exist, none has shown the hobbyist how to build the accessories he wants to enhance the usefulness of his home phone.

Jules H. Gilder, in the first guidebook of its kind, now shows how to build these accessories, and at a small fraction of their retail cost, many for less than $5. This handbook includes the basics of telephony and pertinent telephone regulations; the easy-to-follow plans it provides are all geared to practical application.

Containing useful schematics, basic building tips, and printed circuit layouts, *Telephone Accessories You Can Build* opens the door to a world of telephone electronics for hobbyist and technician alike.

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[illegible] paper

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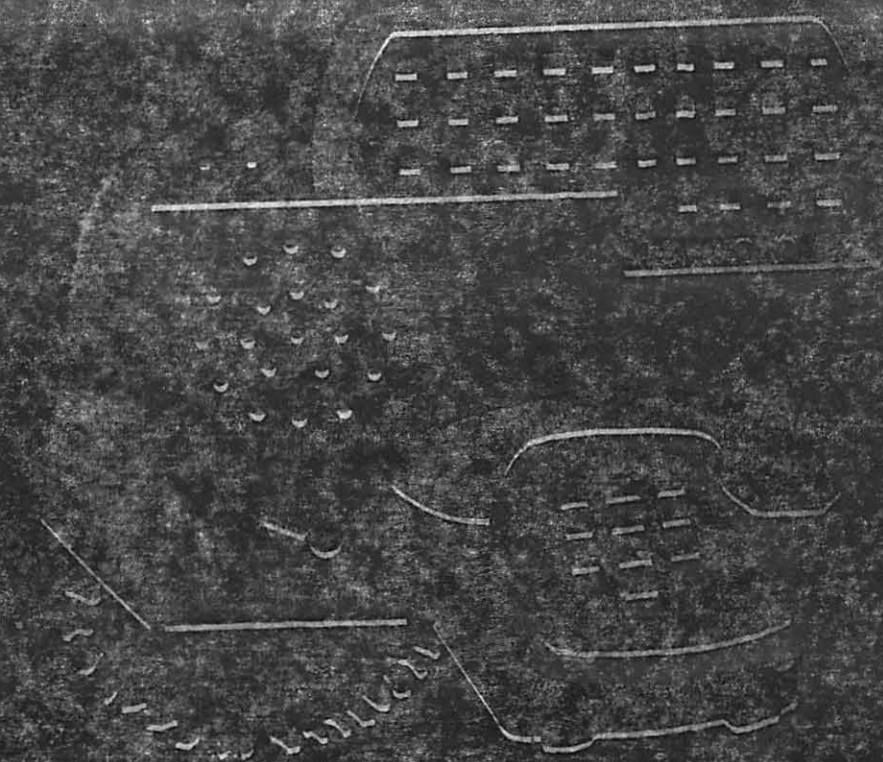
GILDER

TELEPHONE ACCESSORIES YOU CAN BUILD

HAYDEN

Telephone Accessories YOU CAN BUILD

JULES H. GILDER

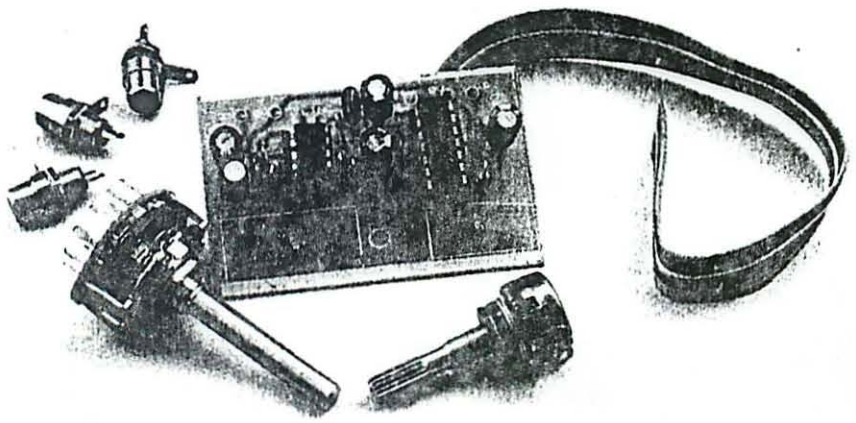


A handbook of accessory building instructions never before available

A Simple, General-Purpose AF Amplifier

You're sure to find a million uses for this handy 1-watt audio amplifier. (Well...at least a few...)

By Ben Spencer, G4YNM
33 New King St
Bath, Avon BA1 2BL
England



This economical, general-purpose AF amplifier features a low-noise, high-input-impedance FET op amp input stage, with a switched input-gain control and an audio power amplifier with continuously variable gain control. All components are readily available, including a PC board.[1] Chances are, you can find most of the components in your junk box.

Circuit Description

Refer to Figure 1. C4 and C5 bypass the power-supply bus. Op amp U1 is a TL081 low-noise FET device with a 50-kΩ input impedance and initial gain controlled via S1 (GAIN 1). The voltage gain settings are 0, 20 and 40 dB for switch positions 1, 2 and 3, respectively. The op amp's lower cut-off frequency is set at 16 Hz by R3 and C2. In the 0-dB position, R3 and C2 have no effect, as the op amp is then operating as a unity gain buffer.

U1's output is fed via C3 to GAIN 2 control R7 and then to the 34-dB audio power amplifier U2.[2] As the power-amplifier gain is fixed at 34 dB, the output level is further controlled by adjusting the input level via R7. Using S1 and R7, it's possible to obtain any gain value up to 74 dB—a considerable range. The AF output can be fed to an 8-Ω loudspeaker or other 8-Ω load. If you use a resistor, ensure it's rated at 2 watts. A LINE output (approximately 600 Ω) is provided via R6.[3] U2's output is short-circuit-proof and has internal thermal limiting.

Construction

Using the single-sided PC board designed for this project (see Note 1), construction is easy. With the exception of the loudspeaker, gain controls and input and output connectors, all components are mounted on the board. If you intend to run a sine-wave input into the amplifier for a prolonged period, attach a heat sink to U2.

To make the amplifier less susceptible to external signals (such as the RF from your transmitter), mount it in a metal case or an enclosure made of double-sided PC-board material. Use shielded wire (RG-174 coax or microphone cable) for the input and output wiring. Keep the input and output leads of the circuit at opposite ends of the enclosure to eliminate the possibility of crosstalk and positive feedback, which would cause unwanted oscillation.

You can mount a loudspeaker within the enclosure, or merely route the LS output line to a suitable jack. Or, route the LS line through a normally closed output jack that disconnects an internal speaker when an external load is plugged into the jack. That way, you'll always have a speaker available and have the option of using an external speaker (or other load) when you want to.

Test and calibration

Ideally, an AF generator[4] should be used to set the input level; however, a simpler, empirical method is to connect the amplifier's input to the audio output of an existing piece of equipment such as a radio receiver, cassette player, or similar source.

Table 1

Required audio-level input for 1-W output into an 8-Ω load for various settings of S1.

S1 Setting	Input Level (V_{RMS})	Overall Gain (Decibels)*
0 dB	0.0566	+34
20 dB	0.0057	+54
40 dB	0.0006	+74

*R7 set to maximum gain (34 dB)

Set S1 to the 0-dB position, the variable GAIN 2 control (R7) to midrange, and adjust the audio source's volume control to an acceptable level. Adjust R7 and check to see that the audio level changes correctly.

Next, set R7 for a quiet level and without adjusting the audio source's volume control, set S1 to the 20-dB position—there should be a significant increase in the audio output level. Repeat the test for the 40-dB position. That's all there is to it!

Summary

Whether at the workbench, in the shack or elsewhere around the home, this amplifier is certain to come in handy.[5] It's inexpensive, easy to build and useful—what more could you ask for?

Notes

[1]PC boards are available from FAR Circuits, 18N040 Field Ct, Dundee, IL 60118-9269. Price: $4 plus $1.50 shipping.

[2]The LM380 power amplifier does have one nasty trait: On the negative-going half cycle of the output waveform, the IC can produce a spurious oscillation as current charges into it. The oscillation frequency is between 5 and 10 MHz. R6 and C7 are used to suppress this oscillation. This behavior is endemic to the device and not a function of this particular project. *

[3]A low dc voltage appears at the LINE output. Use an external 100-µF, 16-V capacitor, if necessary, to dc-isolate the load.—*Ed.*

[4]See B. Spencer, "A Function Generator with a Frequency Counter Digital Readout," *QST*, Apr 1994, pp 35-39; see also Feedback on p 85 of this issue.

[5]This amplifier may be just what you need to build into some other project of yours that needs a bit of audio punch. By hard-wiring the S1 connection and using a fixed-value resistor for R7, you can preset the amplifier gain and not be concerned with variable controls.—*Ed.*

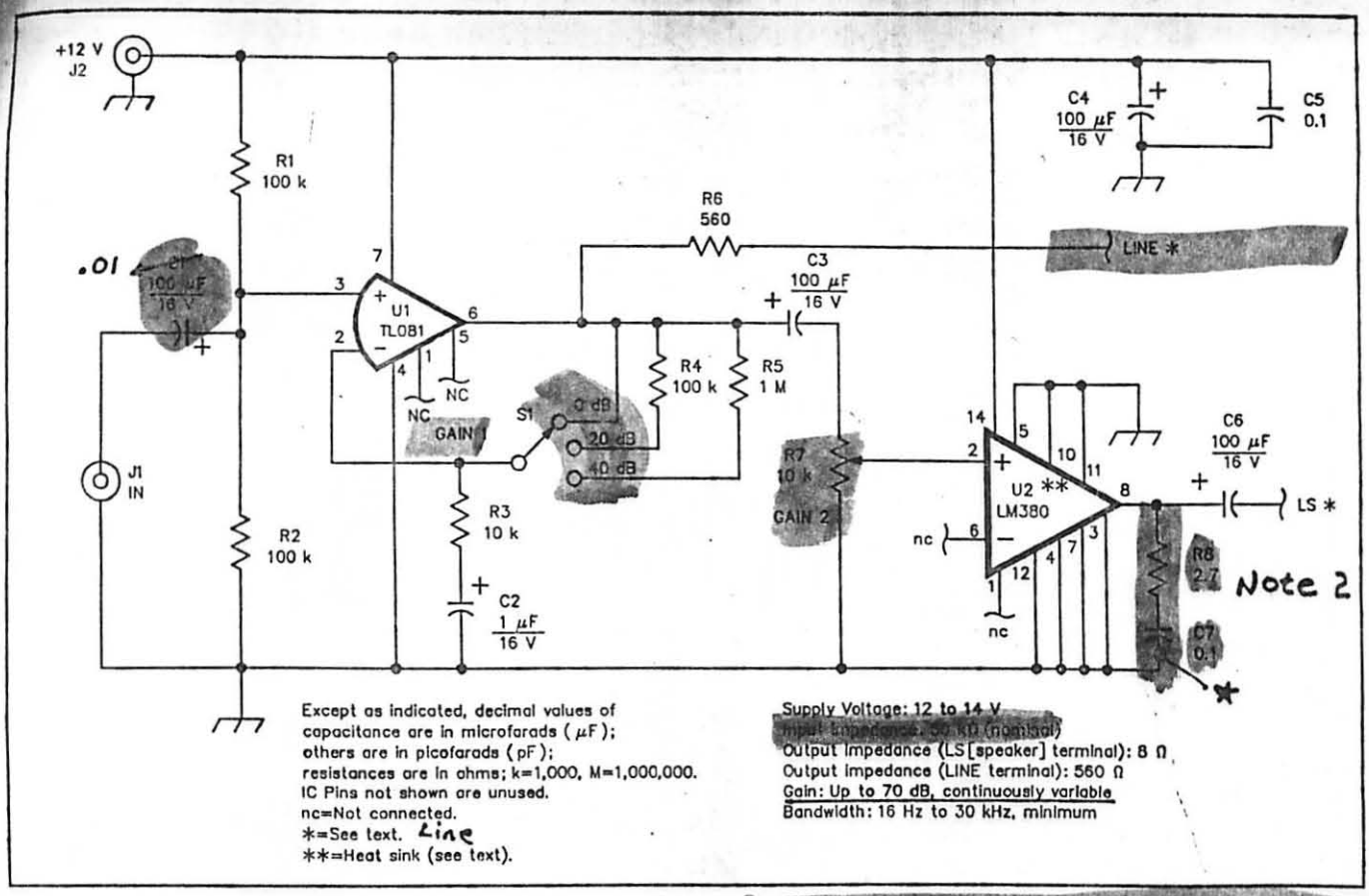


Figure 1—Schematic of the general-purpose AF amplifier. All resistors are ¼-W, 5%-tolerance carbon-composition or metal-film units. Equivalent parts can be substituted. General-purpose IC replacements are shown in parentheses.

C1, C3, C4, C6—100 µF, 16 V radial electrolytic
C2—1 µF, 16 V radial electrolytic
C5, C7—0.1 µF disc ceramic
J1, J2—Phono jack
R7—10-kΩ, log taper, PC-mount potentiometer
S1—Three-position slide or rotary switch
U1—TL081 low-noise FET op amp (NTE857)
U2—LM380 audio power amplifier (NTE740A)

Note: NTE general-purpose replacement components are available from many suppliers including Ocean State Electronics, PO Box 1458, 6 Industrial Dr, Westerly, RI 02891; tel: 800-866-6626 and 401-596-3080; fax 401-596-3590. See the ARRL Parts Suppliers List in the 1995 edition of the *Handbook*. (Don't have a recent *Handbook*? Get a *new* one by simply calling Publication Sales at 203-666-1541, tell 'em what you want and put it on your charge card!—*Ed.*)

Misc: PC board (see Note 1), shielded audio cable (RG-174 coax can be used), enclosure, knobs, output connectors or jacks, hook-up wire, IC heat sink, loudspeaker.

Key Components of Modern Receiver Design

(continued from page 42)

penthouse atop an approximately 120-foot-tall building, I have erected a 40-foot tower atop the building. The tower supports a DJ2UT antenna (40 through 10 meters) at approximately 160 feet above sea level. The antenna can be fully nested in case of storms (not *if* they occur, but *when!*) and is supported sideways by the elevator shaft penthouse.

At both locations, a horizontal V antenna (55 ft per leg), matched by an SGC automatic tuner, serves as backup.

Conclusion

Reader response to the "Key Components" series has shown me that radio amateurs continue to show high interest in understanding and improving the performance of their already excellent radio equipment. There's still much that manufacturers of shortwave transceivers and receivers can do to cater to the needs of this alert and demanding audience.

Notes

[1]U. L. Rohde, "Key Components of Modern Receiver Design," Part 1, *QST*, May 1994, pp 29-32; Part 2, Jun 1994, pp 27-31; Part 3, Jul 1994, pp 42-45. The inductor labeled 9.2 nH in Figure 16 (Part 2) should be 92 nH.

[2]Tom Thompson's "Exploring Intermodulation Distortion in RF Switching and Tuning Diodes" starts on page 25 of this issue.—*Ed.*

[3]Of the PIN diodes I have considered so far, the Siemens and MI204 devices have the longest minority carrier lifetime and are therefore the components of choice for this application. The HP 5082-3081 (which costs more than the MI204) comes next. The MPN3700 (the least expensive of the group) has the shortest minority carrier lifetime of the group. So far, however, Tom Thompson's measurements indicate that all of these devices produce acceptably low IMD at HF and above.

[4]Dr Rohde's original manuscript did not include test data for a Ten-Tec product. Seeking rounded coverage of contest-grade transceivers from all the manufacturers who currently make them, we tested W1AW's Omni VI in the ARRL Lab and included the results with Dr Rohde's assent.—*Ed.*

[5]In an October 28, 1994, circular letter sent to all registered Omni VI owners, Ten-Tec reported that the Omni VI's second-order intercept point can be increased from +40 dBm to over +60 dBm by changing the value of two resistors on the transceiver's BPF/Front End board. An improvement of this magnitude brings the Omni VI's second-order intercept into line with its already excellent third-order IMD performance, and likely makes replacing its front-end diodes desirable only in extreme cases of second-order IMD.—*Ed.*

[6]U. L. Rohde, "Recent Advances in Shortwave Receiver Design," *QST*, Nov 1992, pp 45-55.

[7]U. L. Rohde, "Testing and Calculating Intermodulation Distortion in Receivers," *QEX*, Jul 1994, pp 3-4.

[8]Measuring the coupler's output with both tones switched on simultaneously can be misleading, depending on the measurement technique used. Using an RF microvoltmeter, I have measured something like –16.7 dBm—a measurement 0.3 dB lower than the expected –17 dBm—because the phase sensitivity of its sensing element causes it not to sum the powers of multiple signals perfectly. A true-power meter, such as one using a thermally based sensing element, should indicate –17 dBm with two –20-dBm tones present.

18. Telecorder

At one time or another most of us have had the need to record a telephone conversation. To do so you've probably had to hunt around for a telephone pickup coil, attach it to the phone and your recorder, hope that the batteries in your tape recorder would last and then try not to get tangled up in the wires and accidentally pull the coil away from the telephone.

With a home built telecorder you can eliminate recording problems. For less than the cost of a commercial unit that does not contain its own power supply, you can build this device which will automatically record all incoming and outgoing calls from your phone. It works with your cassette recorder and any telephone or extension.

The telecorder contains a built-in regulated power supply which can be used to power the recorder and save batteries. This is particularly important in continuous monitoring applications.

About the Circuit

The heart of the telecorder is the TEL 100 telephone sensing module (Fig. 18-1). This module is the element that interfaces the phone line with the recorder. When connected to the red and green wires of the telephone, it senses the voltage across these two wires and produces a switching signal that activates a relay connected

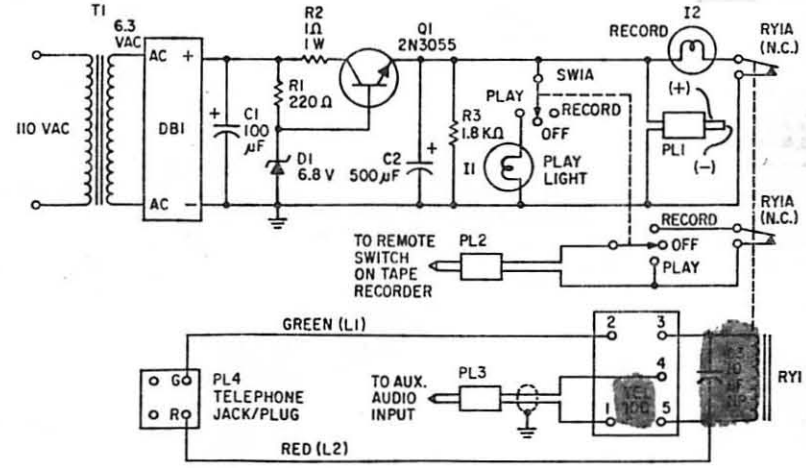


Figure 18-1 *Telecorder Schematic*

across terminals 3 and 5. A relay switching signal is produced every time the telephone receiver is lifted off the hook.

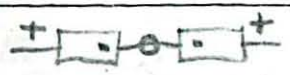
The TEL 100 module also isolates the recorder from the phone line and protects the input of the tape recorder from damage that might be caused by the 90V ringing signal. A 10 µF non-polarized capacitor is placed across the relay to keep the ring signal from affecting it.

The audio signal from the phone line is fed through the module into the auxilliary audio input jack of the cassette recorder. The operation of the tape recorder is controlled by the relay, whose normally-closed contacts are connected to the remote switch jack on the recorder.

The design of the power supply portion of the telecorder is relatively straightforward. The ac line voltage is stepped-down and rectified, and then applied to a regulating circuit. The output voltage of the supply is determined by the voltage across zener diode D1 minus the 0.7V drop across transistor Q1. If your recorder requires a 7.5V supply, substitute an 8.2V zener diode for the 6.8V one specified.

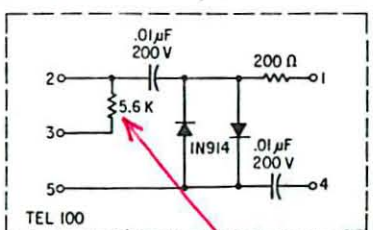
Parts List

C1 — 100 µF 16wVdc electrolytic	Q1 — 2N3055
C2 — 500 µF 16wVdc electrolytic	R1 — 220 ohms
C3 — 10 µF 50wVdc non-polarized	R2 — 1 ohm 1 watt
D1 — 6.8V zener diode	R3 — 1.8k ohms
DB1 — diode bridge, 50V piv	RY1 — 24V dpdt relay, coil resistance 2000 ohms
I1 — 6V lamp	SW1 — dpdt center off switch
I2 — 6V lamp	T1 — power transformer 115V primary, 6.3V secondary
PL1 — coaxial power plug	TEL 100 module (Fig. 18-2)
PL2 — subminiature phone plug	
PL3 — miniature phone plug	
PL4 — telephone jack-in-a-plug	



USE BACK TO BACK Lytics 2X V + 2X UF

FOR NON Polar Cap P525 Master Hand Book 1K Circuits



Tel 100 modified w/o Resistor

Figure 18-2 Telecorder Module

Delete 5.6 K Resistor & use

Construction

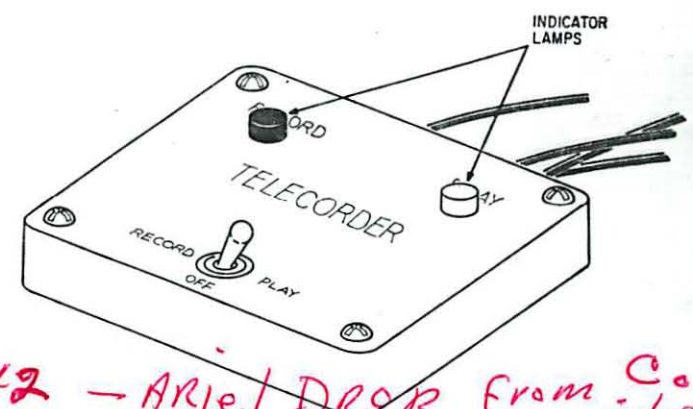
The circuit can be easily assembled on a perforated board. Except for the two panel lights and the control switch, all components are mounted directly on the circuit board. When installing the semiconductors be sure to observe the proper polarities and heat sink their leads while soldering.

In the prototype the circuit board was mounted in a 6¼" × 3⅝" × 2" plastic utility box. Three holes are drilled in the box to accommodate wires going to and from the telecorder. Be sure to line these holes with rubber grommets to prevent frayed wires.

While the layout of the circuit is not critical, it is important that the audio input lead to the tape recorder be shielded to prevent 60 Hz hum from being picked up. A two-conductor shielded cable is recommended with the shield connected to ground at the pc board. Connections to PL2 and PL3 are not critical in that any wire can be connected to the tip or the body of the plug.

Installation and Operation

The telecorder (see Fig. 18-2) can be connected to any telephone or directly to the telephone junction box. But the easiest way to hook it up is to use a telephone jack/plug which is available from most electronic parts suppliers. This device fits in between a standard telephone plug and a standard jack. Two of the four terminals on the jack/plug are marked R and G (for red and green). The L2 wire from the telecorder is connected to the R terminal and the L1 wire is connected to the G terminal. The jack/plug is then inserted into the telephone jack and the plug on the telephone is inserted into the telecorder's jack/plug.



5+2 — Ariel Drop from C.O.
1+4 to Equipment — onsite

Figure 18-3 Telecorder

2 — 1 out
IN
5 — 4

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